SAG-14: Characterization of Stars Targeted for NASA Exoplanet Missions – Keivan Stassun, chair

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The accuracy with which we can determine the basic properties of any planet from any exoplanet mission depends fundamentally on our knowledge of the host stars. In particular, a planet's mass, size, density, composition, insolation, age, and past and future evolutionary history can only be determined via the known properties of the host star and their respective uncertainties. Thus, the star properties have a direct influence on our knowledge of both exoplanet *physics* (parameters such as mass and radius) and exoplanet *astrophysics* (history of formation, evolution, migration, etc.). Yet, very often, the exoplanet host stars turn out to be inadequately characterized, which has become a bottleneck for the field despite the trove of planet discoveries delivered by NASA missions such as Kepler and K2. "Know the star, know the planet" has become a cri de coeur for the exoplanet science community.

Recently, the community has turned the discussion towards the large gap between the rapid pace of exoplanet discovery and the slow pace of follow-up stellar characterization. For example, the majority of Kepler Objects of Interest (KOIs) still remain poorly characterized because the host stars remain poorly characterized. Indeed, stellar characterization efforts in the era of Kepler have in general been (1) in a constant state of backlog, (2) largely uncoordinated in terms of target prioritization, data quality, and analysis methods, and (3) usually not independent of the planet discovery teams.

The TESS mission is now set to imminently provide an additional large number of small planets that will need to be accurately characterized for the primary mission deliverables. With additional exoplanet missions planned for the near future, it is vitally important to determine what activities will reduce scientific risk and maximize return from TESS and from other near-term exoplanet missions. In particular, there are projects that can be undertaken soon to capitalize on extant observing resources, to quantify stellar characteristics en masse and rapidly fulfill core science from upcoming exoplanet missions. Importantly, we recognize that the results from the Gaia mission promise to address many stellar characterization issues needed on the TESS timescale. Even so, there may still be gaps in the additional data products needed to characterize the host stars, such that the community will not be ready to the extent required for ultimate mission success and maximum output for the scientific community and for the public in general.

This SAG will bring together experts in the field, whose specialties include a number of multidimensional approaches to stellar characterization, in order to identify scientific programs that will benefit TESS and follow-on exoplanet missions. The SAG will also build on the previous (Jan 2015) ExoPAG mini-symposium on stellar characterization. Of particular interest are mission-critical observational programs that must be completed before the launch of TESS or before the end of its primary data collection mission. Specifically, the major question this SAG will address is:

"What exoplanet host-star characterization programs can be undertaken *now* to ensure the success of the TESS mission and its follow-on missions, and maximize their scientific return?"

In the process of answering this question, the SAG will:

1. Identify both mission critical and mission enhancing programs -- including observational programs and analysis methodologies -- especially in light of known gaps from previous and current missions, including in particular gaps that will remain after the expected deliverables from Gaia,

2. Identify immediate science to come out of each program, as well as the program's direct impact on the TESS mission and on TESS follow-on missions,

3. For each proposed program, quantify the improved scientific return for the TESS mission and for planned follow-on exoplanet missions,

4. Emphasize programs that can be executed using existing (NASA) resources, and that represent an opportunity for scientific independence from the mission and/or exoplanet discovery teams.